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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/032,682
Filing Date: December 28, 2001
Appellant(s): JOHNSON, DANIEL P.

David D'Zurilla (Reg. No. 36,776)
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed December 26, 2006 appealing from the Office action mailed July 20, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Hillier et al. "Introduction to Operations Research (6th ed)" McGraw-Hill, Inc., pages ix-xiii, 8-80, 558-607, 986-998, (c) 1995.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-20 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Hillier et al. (Introduction to Operations Research (6th ed)).

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-20 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

35 U.S.C. § 101 requires that the claims produce a final result that is useful, concrete, and tangible.

According to the utility requirement, the claimed invention has to be specific, substantial, and credible. Claims 1-20 are directed toward a mathematical formula

without any specific, substantial, or credible result. The formula is never applied to yield a practical application. While claims 2-5 recite that the solution is a schedule for a manufacturing process, a schedule for operating an oil refinery, a plan for a manufacturing process, and a plan for operating an oil refinery, respectively, the claimed invention does not clarify how the mathematical operations are specifically adapted to yield a specific, substantial, or credible result in relation to a schedule or plan for a manufacturing process or for operating an oil refinery.

As per the tangibility requirement, the claimed invention must set forth a practical application that produces a real-world result. As discussed above, the claimed invention recites a mathematical formula without applying the formula to a specific practical application with a real-world result. Even though claims 1-5 generally recite potential applications of the mathematical formula, there is never any express connection made between the equations and how they yield any results relevant to scheduling or planning. In other words, it is never made clear how the recited equations are adapted to a real-world application. Without relating the equation variables to a particular application that yields a result specific to that application, the equations are meaningless in a real-world context.

Regarding the concreteness requirement, the claimed invention must produce a result that is substantially repeatable or reproducible. Again, as discussed above, there is no meaningful result produced by the claimed invention. Consequently, the mathematical formula *per se* is abstract and, without any understanding of what the

recited variables represent, the results of the claimed invention are not substantially repeatable or reproducible.

Claims 1-20 fail to produce a useful, concrete, and tangible result and are therefore deemed to be non-statutory.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Regarding the concreteness requirement under 35 U.S.C. § 101, the claimed invention must produce a result that is substantially repeatable or reproducible. As discussed above, there is no meaningful result produced by the claimed invention. Consequently, the mathematical formula *per se* is abstract and, without any understanding of what the recited variables represent, the results of the claimed invention are not substantially repeatable or reproducible. The Examiner has looked toward the specification for clarification of an intended practical application. While the

specification generally states that the invention is used for scheduling or planning and provides some examples of specific applications (pages 4-11 of the specification), the details of the mathematical equations used as part of the invention as addressed on pages 11-42 of the specification are very generic in nature and never explain the significance of each variable with respect to each possible application of the equations. Consequently, one of ordinary skill in the art would not have known at the time of Applicant's invention how to make and/or use Applicant's intended invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-20 are directed toward solving equations that are based on variables, relationships, and constraints that are never explicitly defined. Consequently, the intended metes and bounds of the claimed invention cannot be assessed. Without any particular context attributed to these variables, relationships, constraints, and equations, the scope of the claimed invention is ambiguous. The claims are very nebulous and abstract in nature; therefore, the Examiner is unable to focus on a clear and defined invention. For example, claims 2-5 recite that the solution is for a schedule or plan. How is a schedule or plan created merely by solving a set of non-convex equations and

determining whether a solution is optimal, feasible, or infeasible. How is such an analysis applied to produce meaningful results in relation to a schedule or plan?

Please clarify the intended scope of the "global subdivision search." Does this term refer to an algorithm or mathematical operation invented by Applicant or is it a synonym for a well-known algorithm or mathematical operation, such as one relating to subdivision and global optimization or branch-and-bound algorithms for global optimization? For examination purposes, it will be assumed to be one of the well-known options.

Under 35 U.S.C. § 112, 2nd paragraph, Applicant is required to clearly point out and distinctly claim the intended invention. This requirement has not been met.

Appropriate correction is required.

In light of the numerous rejections under 35 U.S.C. § 101 and 112, 1st and 2nd paragraphs, the following art rejection reflects Examiner's best understanding of the claimed invention.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-20 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Hillier et al. (Introduction to Operations Research (6th ed)).

The claimed invention recites various old and well-known optimization techniques in the area of operations research, without any specific details of how these techniques are applied to a particular problem. The claimed techniques are addressed throughout Hillier. The table of contents and index as well as chapters 2, 3, and 13 have been provided to show the core concepts addressed by the claimed invention.

Regarding the step of "determining whether a solution to the scheduling problem is optimal, feasible, *or* infeasible," Hillier discusses a general approach for determining whether the solutions of a model are feasible or infeasible (see page 35). The goal is to identify an optimal solution (see page 36). Pages 57-60 of Hillier apply this analysis to a specific scheduling problem to find an optimal solution. Pages 62-63 of Hillier set forth a case study in a manufacturing environment for choosing a product mix on a monthly basis, which is also a type of scheduling problem. Also discussed (on pages 65-67 of Hillier) is an example of planning supply, distribution, and marketing at Citgo Petroleum Corporation (which manages oil refineries). Planning supply and distribution would necessarily require scheduling at some level.

(10) Response to Argument

Regarding the rejection under 35 U.S.C. § 101, Appellant states, "It should also be noted that operators of manufacturing plants are intimately familiar with the variables and constraints associated with the operations of their plants, and are well able to set up quadratic equations to address such variables and constraints. Still further, each plant likely has different sets of variables and constraints, and the identification and selection of such are not a part of the invention." (Page 9 of the Appeal Brief) Appellant

has the burden of completely establishing the metes and bounds of the desired claim coverage. Throughout prosecution, the Examiner has presented rejections in an attempt to have Appellant explain what the intended invention is. If Appellant has not invented an equation with defined variables and constraints, then what is Appellant's invention? If Appellant continues to assert that the invention involves the pure integration of mathematical operations, then this supports the Examiner's rejections of claims 1-20 as being non-statutory since they are directed toward a mathematical algorithm *per se*. Appellant further supports the Examiner's position in his statement that "Claim 1 specifically sets forth how the equations are solved by applying a bound propagation process, a local linear bounding process, a local linearization process, and a global subdivision search. The other two independent claims, claims 6 and 12, recite substantially similar elements. Thus, not only does it specify how the equations are solved, it provides the additional utility of determining whether the solution is optimal, feasible or infeasible." (Page 10 of the Appeal Brief) Appellant's own description of claim 1 renders it as a pure mathematical algorithm. Determining whether a solution is optimal, feasible, or infeasible amounts to nothing more than a mathematical algorithm without a specific result that applies the mathematical algorithm to a real-world application. While claim 1 broadly recites that the solution is to a scheduling problem, the claim as a whole does not convey how the mathematical operations are customized to solving a scheduling problem; therefore, the recited mathematical operations remain nothing more than generic math without a practical application. In order for the invention to be concrete, the claimed invention must produce a result that is

substantially repeatable or reproducible. Since every permutation of variables, relationships, and constraints may be very different, Appellant has not demonstrated how a solution would be substantially repeatable or reproducible. Instead, varying problems could very well require varying solutions and Appellant's claims and specification both fail to limit the intended invention to yielding a solution that is substantially repeatable or reproducible. (It should also be noted that Appellant has yet to respond to the Examiner's questions regarding the metes and bounds of the recited "global subdivision search," raised in the § 112, 2nd paragraph rejection.)

Appellant argues that the claimed invention is statutory under 35 U.S.C. § 101 because the background of the specification provides various real-world examples of scheduling (page 9 of the Appeal Brief); however, the claims do not clearly set forth how scheduling occurs. The claimed invention effectively jumps from listing undefined variables, relationships, and constraints to solving a scheduling problem without any details regarding how such a goal is accomplished. This is analogous to providing someone with a recipe to make a "Novel Dessert" with only a general reference to "ingredients related to making desserts" (without any specific ingredient names, measurements, mixing instructions, or baking instructions). Without knowledge of the scope of scheduling, it is unclear whether the extent of scheduling is sufficient enough to be useful. Appellant continues to argue that the Examiner's analogy of making a dessert to the claimed invention "is at best irrelevant, and at worst is misleading. There is a clear distinction, and perhaps no relationship, between a batch of ingredients and the ability of a person of skill to concoct an unnamed dessert, and the use of variables,

relationships, and constraints in a scheduling problem, solving non-convex equations by applying a bound propagation process, a local linear bounding process, a local linearization process, and a global subdivision search, and determining whether a solution to the scheduling problem is optimal, feasible, or infeasible." (Page 11 of the Appeal Brief) The Examiner respectfully disagrees. The dessert analogy is very relevant. Appellant is required to clearly describe in his specification what he has invented and then Appellant is also given the burden of capturing the intended metes and bounds of his invention in the claim language. Instead, Appellant has left so many gaps between getting from point A (e.g., deciding which variables, relationships, and constraints to use based on a particular scheduling environment) to point B (e.g., determining whether a solution to the scheduling problem is optimal, feasible, or infeasible) that one of ordinary skill in the art is left wondering what Appellant's useful, concrete, and tangible result is. Additionally, if one of ordinary skill in the art has to fill in these blanks, regardless of whether or not this skilled artisan can accomplish such a feat one way or another, it would appear that the skilled artisan establishes the intended scope of the invention, based on his/her interpretation of the variables, relationships, and constraints to be used and how they are to be plugged into the claimed, generic mathematical operations. At this point, one is left wondering what Appellant has invented versus what a skilled artisan would be capable of inventing with some vague hints from the Appellant.

As far as tangibility is concerned, Appellant argues that "a scheduling problem in a particular business operation is a real world effect" (page 11 of the Appeal Brief);

however, there is no real-world effect produced by the claimed invention. For example, a solution can be found for a schedule without actually putting the schedule into practice. The solution can remain in the mind of a human user and could potentially never effect real-world operations. Also, all because it is determined whether a solution to a scheduling problem is optimal, feasible, or infeasible does not mean that a schedule is actually created or altered. For example, if a solution is determined to be optimal, maybe an existing scheduling is never altered and therefore no real-world effect is achieved. Maintaining status quo (i.e., doing nothing) does not amount to a real-world effect. Even if a solution is determined to be feasible, this does not mean that a recommended schedule is implemented. Conversely, even if a solution is determined to be infeasible, what happens next? The claimed invention stops short of producing any tangible result that has any direct effect in the real world.

Appellant also argues that the claims in the instant application are analogous to those presented in the *State Street* decision and, therefore, they are statutory (page 11 of the Appeal Brief). The Examiner respectfully disagrees. The fact pattern in *State Street* is entirely different. For example, the claims at issue in the *State Street* decision very specifically process data related to portfolio income, expenses, gain, and loss and then allocate this data among each fund in the portfolio. The portfolio claims in *State Street* deal with very concrete factors that are used to effectively produce a final share price. These factors are defined and have reasonable limits in how they are interpreted. Notably, they are not referred to merely as variables, relationships, and constraints to be processed by various generic mathematical operations, as is the case in Appellant's

claims. Therefore, the discussion of the State Street decision is only pertinent in the sense that it reminds us that a useful, concrete, and tangible result is required by the claimed invention in order to qualify the claims as statutory, thereby supporting the Examiner's position.

Regarding the 112, 1st paragraph rejection of the claims, Appellant submits that "the variables recited in the claims may represent qualities, quantities, timing, and the like. Moreover, specific examples of one or more embodiments are provided in excruciating detail in the specification." (Page 12 of the Appeal Brief) Appellant's claims appear to attempt to cover the scope of at least multiple embodiments; however, the extremely broad nature of the claims has caused the claimed invention to lose sight of the particulars of these disclosed embodiments. Appellant's specification simply does not sufficiently address the overly broad scope of the claims. Appellant "further respectfully submits that one of skill in the art of business and/or operations management would, without undue experimentation, be able to select pertinent variables for their processes and apply them to the subject matter as disclosed in the present application." (Page 12 of the Appeal Brief) The Examiner emphasizes that such a feat must be accomplished without undue experimentation and Appellant has provided no evidence to the contrary. Returning to the recipe example, given a list of commonly used baking ingredients, one might easily concoct various desserts, yet it would never be clear if one of these concocted desserts would be the inventor's intended dessert. It is Appellant's responsibility to clearly set forth Appellant's intended invention in both the specification as well as the claims. The scope of Appellant's

disclosure does not explain how one cookie cutter model can address all of the potential embodiments without at least some basic modification to each model to take into account variables, relationships, and constraints that may be unique to each embodiment/model. Again, this is analogous to providing a listing of general, commonly used baking ingredients, and expecting someone to be able to guess how to make the intended "Novel Dessert." The gaps that are missing in the claimed invention can be significantly different based on which variables, relationships, and constraints are used, which also vary widely based on which type of scheduling problem is being solved (e.g., scheduling for a manufacturing process or for operating an oil refinery). Ultimately, Appellant fails to convey the particular metes and bounds of the intended invention in the claim language. Admittedly, Appellant has various alternate embodiments in the specification. Without focusing on a specific embodiment, the claimed invention lacks any meaningful metes and bounds that clearly define its scope. Furthermore, the specification does not provide a genus that is sufficiently encompassing to consistently perform all of these embodiments (or species); therefore, the specification is lacking in the level of detail of disclosure needed to support the scope of enablement required by the breadth of the claimed invention. Additionally, if one of ordinary skill in the art has to perform so much guesswork to fill in these blanks, regardless of whether or not this skilled artisan can accomplish such a feat one way or another, it would appear that the skilled artisan establishes the intended scope of the invention, based on his/her interpretation of the variables, relationships, and constraints to be used and how they are to be plugged into the claimed, generic mathematical operations. At this point, one

is left wondering what Appellant has invented versus what a skilled artisan would be capable of inventing with some vague hints from the Appellant.

Regarding the § 112, 2nd paragraph rejection, Appellant argues that the variables, relationships, and constraints of claims 1-20 are explicitly defined. "The specification states that in an embodiment, the variables may represent qualities, quantities, timing, and the like. The Applicant respectfully submits that a person of skill in business operations and/or manufacturing operations would be able to identify the variables that are pertinent to his or her industry (such as the quantity of oil in a tank in an oil refinery), and further would be able to use such variables and values in connection with the present disclosure." (Page 12 of the Appeal Brief) Even if Appellant's statement that "the variables may represent qualities, quantities, timing, and the like" were read into the claimed *variables*, the phrase "and the like" still raises questions regarding what metes and bounds are attributed to "and the like" and, therefore, the metes and bounds of *variables*. "And the like" implies that there is some obvious connection uniting the characteristics of qualities, quantities, and timing; however, these words are so broad in and of themselves that "and the like" could produce an endless list of equally broad terms to be read into *variables*. Furthermore, even if Appellant were given the benefit of defining the claimed *variables* as "qualities, quantities, and/or timing," how would the corresponding relationships and constraints be defined. Would they vary if variables were read as qualities versus quantities versus timing? As stated in the § 112, 2nd paragraph rejection, without any particular context attributed to these variables, relationships, constraints, and equations, the scope of the

claimed invention is ambiguous. The claims are very nebulous and abstract in nature; therefore, the Examiner is unable to focus on a clear and defined invention. For example, claims 2-5 recite that the solution is for a schedule or plan. How is a schedule or plan created merely by solving a set of non-convex equations and determining whether a solution is optimal, feasible, or infeasible. How is such an analysis applied to produce meaningful results in relation to a schedule or plan? Appellant has yet to answer any of these questions. Additionally, the § 112, 2nd paragraph rejection has asked for clarification regarding the intended scope of the "global subdivision search." (Does this term refer to an algorithm or mathematical operation invented by Applicant or is it a synonym for a well-known algorithm or mathematical operation, such as one relating to subdivision and global optimization or branch-and-bound algorithms for global optimization? For examination purposes, it was assumed to be one of the well-known options.) Appellant has not even attempted to address the meaning of a "global subdivision search"; therefore, this rejection is also maintained.

Regarding the rejection of claims 1-20 under 35 U.S.C. § 102(b), Appellant asserts that the "rejection did not state the grounds thereof fully and clearly, and furthermore amounted to an omnibus rejection." (Page 13 of the Appeal Brief) First, due to the extensive nature of the rejections under 35 U.S.C. §§ 101 and 112, 1st and 2nd paragraphs, it has been difficult for the Examiner to assess the true metes and bounds of the invention; therefore, the art rejection has been presented to represent the Examiner's best understanding of the claimed invention. Second, the Examiner has provided Appellant with a reference and cited specific chapters, thereby giving a little

more than just an omnibus rejection of the claims. For example, regarding the step of "determining whether a solution to the scheduling problem is optimal, feasible, *or* infeasible," Hillier discusses a general approach for determining whether the solutions of a model are feasible or infeasible (see page 35). The goal is to identify an optimal solution (see page 36). Pages 57-60 of Hillier apply this analysis to a specific scheduling problem to find an optimal solution. Pages 62-63 of Hillier set forth a case study in a manufacturing environment for choosing a product mix on a monthly basis, which is also a type of scheduling problem. Also discussed (on pages 65-67 of Hillier) is an example of planning supply, distribution, and marketing at Citgo Petroleum Corporation (which manages oil refineries). Planning supply and distribution would necessarily require scheduling at some level.

Appellant also requests that the Examiner identify where Hillier addresses the following limitations: "forming non-convex quadratic equations and solving the non-convex quadratic equations by applying a bound propagation process, a local linear bounding process, a local linearization process, and a global subdivision search" and "upon failing to find a solution to the scheduling problem, that a global subdivision search is applied to a bounding region to produce two or more regions, and furthermore that the bound propagation, local linear bounding and local linearization processes are iteratively applied to each of the two or more regions until it is determined that the solution to the scheduling problem is optimal, feasible, or infeasible." (Pages 13-14 of the Appeal Brief) Keeping in mind that many rejections remain under 35 U.S.C. §§ 101 and 112, 1st and 2nd paragraphs (including questions regarding the metes and bounds

of a "global subdivision search"), the Examiner submits that the aforementioned claim limitations are generally addressed on the following pages of Hillier:

forming non-convex quadratic equations (pages 571, 603-606 -- The example on pages 605-606 shows quadratic equations) and solving the non-convex quadratic equations by applying a bound propagation process (Pages 603, 605 -- Local and global maxima are approximated), a local linear bounding process (Pages 603, 605 -- Local and global maxima are approximated), a local linearization process (Pages 603, 605 -- Local and global maxima are approximated), and a global subdivision search (page 603 -- A barrier function or convergence forces the solutions to stay inside the feasible region)

upon failing to find a solution to the scheduling problem, that a global subdivision search is applied to a bounding region to produce two or more regions, and furthermore that the bound propagation, local linear bounding and local linearization processes are iteratively applied to each of the two or more regions until it is determined that the solution to the scheduling problem is optimal, feasible, or infeasible (Pages 603-606 -- The calculations are iteratively performed until a best approximation is reached and various barriers or regions may be established throughout this process; Hillier discusses a general approach for determining whether the solutions of a model are feasible or infeasible (see page 35). The goal is to identify an optimal solution (see page 36). Pages 57-60 of Hillier apply this analysis to a specific scheduling problem to find an optimal solution. Pages 62-63 of Hillier set forth a case study in a manufacturing environment for choosing a product mix on a monthly basis, which is also a type of

scheduling problem. Also discussed (on pages 65-67 of Hillier) is an example of planning supply, distribution, and marketing at Citgo Petroleum Corporation (which manages oil refineries). Planning supply and distribution would necessarily require scheduling at some level)

In conclusion, Appellant's arguments are not persuasive.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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